



## T221

### Trapezoidal Stage Speaker System

- PRO™ circuit provides HF driver protection
- Integral stand mount
- Enclosure is arrayable incorporating constant-directivity 60° x 40° horn
- High output, 400-W, 12-inch woofer
- Roadworthy enclosure with metal corners and grille, and heavy-duty handles
- Biamped or full range operation—simple biamp instructions included inside the enclosure

#### SPECIFICATIONS

Frequency Response, Measured at 10 Feet on Axis, Swept 1/3 -octave, Half-Space Anechoic Environment (see Figure 1; curve shown has been normalized for 1 watt/1 meter):

78-16,000 Hz

Low-Frequency 3-dB-Down Point:

78 Hz

Usable Low-Frequency Limit (10-dB-down point):

62 Hz

Half-Space Reference Efficiency:

5.7 %

Long-Term Average Power-Handling Capacity per ANSI/EIA RS-426-A 1980 (see Power-Handling Capacity section):

400 watts

Recommended Crossover Frequency:

1,200 Hz

Crossover Slopes,

Recommended:

24 dB per octave

Minimum:

12 dB per octave

Long-Term Average Power-Handling Capacity (see Power-Handling Test section),

Low Frequency (per ANSI/EIA RS-426-A 1980):

400 watts

High Frequency (per AES2-1984/ANSI S4.26-1984):

60 watts

Sensitivity (far-field SPL referred to 1 meter, 1-watt input, anechoic environment, band-limited pink noise),

Low Frequency (200-1,200 Hz):

100 dB

High Frequency (1,200-5,000 Hz):

112 dB

SPL at Full Power (far-field SPL at 1 watt/1 meter referred to full power, anechoic environment, band-limited pink noise), Long-Term Average/Peak,

Low Frequency (200-1,200 Hz):

126 dB/133 dB

High Frequency (1,200-5,000 Hz):

129 dB/135 dB

Impedance,

Nominal (low frequency/high frequency):

8 ohms/8 ohms

Minimum (low frequency/high frequency):

7.0 ohms/6.3 ohms

Average Efficiency

Low Frequency:

5.7%

High Frequency:

25%

Nominal Coverage Angle,

Horizontal:

60°

Vertical:

40°

Beamwidth (angle included by 6-dB-down points on polar responses, indicated one-third-octave bands of pink noise, see Figure 4),

3,000 to 16,000 Hz Horizontal:

60° (+13°, -9°)

2,000 to 16,000 Hz Vertical:

40° (+20°, -2°)

Directivity Factor  $R_0(Q)$ , 800-to 16,000-Hz Median (see Figure 4):

19.1 (+11.8, -13.1)

Directivity Index  $D_i$ , 800-to 16,000-Hz Median (see Figure 4):

12.8 dB (+2.3 dB, -5 dB)

Distortion Response (40 W), 10% Rated Input Power (on axis at 1 meter from system; see Figure 5),

Second Harmonic,

100 Hz:

3.5%

1,000 Hz:

1%

10,000 Hz:

15.8%

Third Harmonic,

100 Hz:

0.89%

1,000 Hz:

2.2%

10,000 Hz:

7.1%

Transducer Complement,

Low Frequency:

High-performance 305-mm (12-in.) woofer in a vented enclosure

High Frequency:

HP64M 60° x 40° horn mounted to DH2T compression driver

Box Tuning Frequency:

75 Hz

Driver Protection, High Frequency:

Solid-state self-resetting circuit (PRO™ circuit) drops input 6 dB; blocking capacitor with 800-Hz corner frequency and 6-dB-per-octave slope

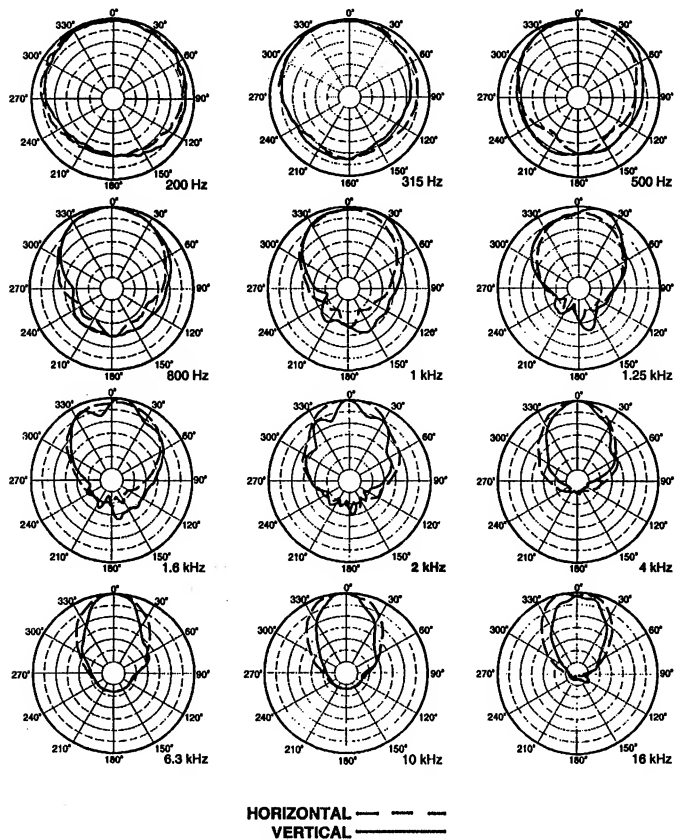
Enclosure Materials and Color:

7-ply void-free plywood covered with black carpet

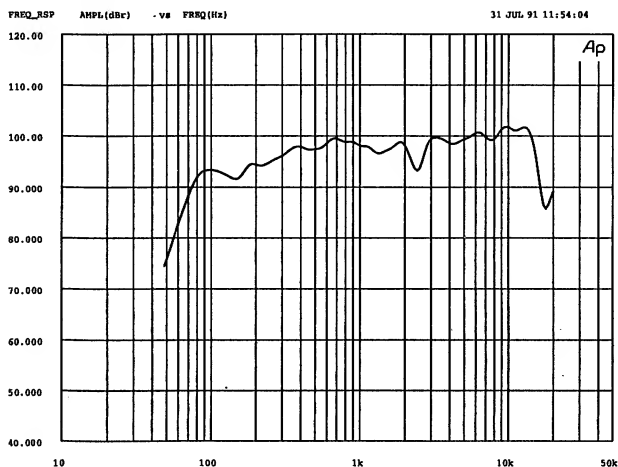
Grille:

Black powder coated, vibration-resistant, steel, removable

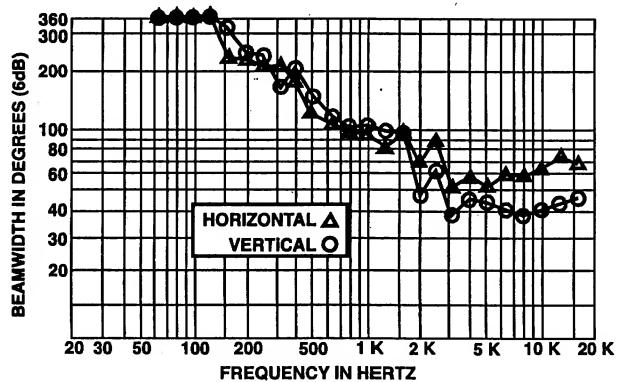
**FIGURE 1 — T221 Polar Response  
(one-third-octave pink noise)**



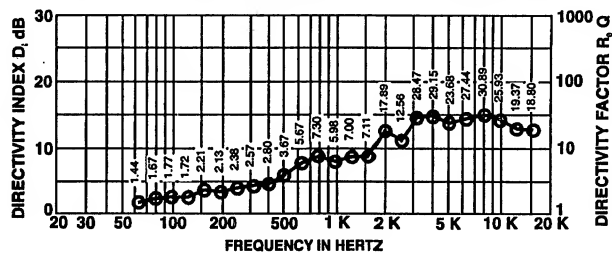
**FIGURE 2 — T221 Axial Frequency Response, 1 Watt/1 Meter**



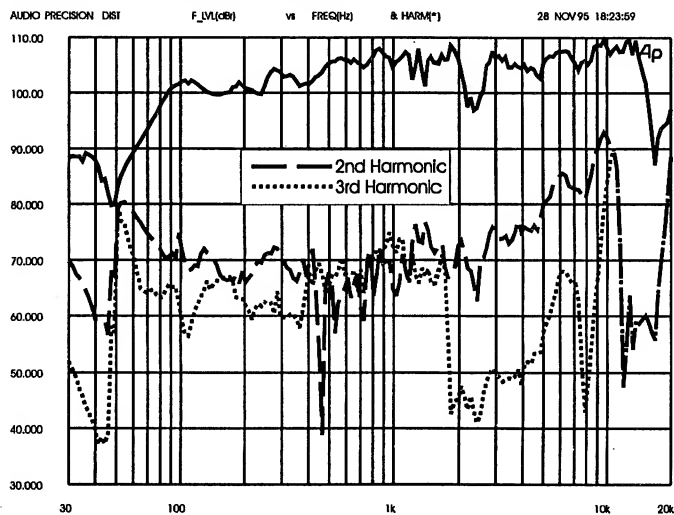
**FIGURE 3 — T221 Beamwidth vs. Frequency, Whole Space (anechoic)**



**FIGURE 4 — T221 Directivity vs. Frequency, Whole Space (anechoic)**



**FIGURE 5 — T221 Distortion at 40 watts**



## Dimensions,

### Height:

714 mm (28.1 in.)

### Width at Front:

417 mm (16.4 in.)

### Width at Rear:

170 mm (6.7 in.)

### Depth:

480 mm (18.9 in.)

### Side-Wall Draft Angle:

15°

### Net Weight:

25 kg (55 lb)

### Shipping Weight:

29.5 kg (65 lb)

## DESCRIPTION

The compact, trapezoidal-shaped Electro-Voice T221 is a 400-watt, two-way, high-efficiency, constant-directivity stage system. A stand socket for 1-3/8-inch diameter stands, such as the Electro-Voice 100BK, is mounted on the bottom panel of the enclosure. The system combines professional-quality components, arranged in a vertical array, with an unusually durable Thiele-Small-aligned vented enclosure. The result is clear and articulate, high-quality sound.

The enclosure is constructed of 7-ply void-free plywood. This high-strength shell is covered with densely woven, abuse-resistant black carpeting.

The high-frequency section of the T221 utilizes a 60° x 40° constant-directivity horn driven by a wide-bandwidth, titanium-diaphragm DH2T driver. This driver uses a unique convex-drive Time Path™ phasing plug structure (U.S. Patent #4,525,604) for smooth and extended high-frequency performance. The voice coil is coupled to the diaphragm with EV's exclusive Resonant Drive™ technology. This increases and smoothes the high-frequency response and reduces the amount of internal equalization required for flat frequency response.

EV's self-resetting PRO™ circuit is built into the crossover network to guard the compression driver from damage. If input power to the driver exceeds the nominal rating, the PRO circuit is activated, reducing the power delivered to the driver by 6 dB. The system will remain in this mode of operation until input power is reduced to a safe level.

The optimally vented bass section of the T221 is designed using Thiele-Small parameters for efficient performance to below 78 Hz. The high-power 12-inch woofer features beryllium copper lead wires with a low-mass, edge-wound voice coil and high-temperature materials. The woofer also includes mechanical improvements and refinements that allow it to sustain unusually high power levels over extended time periods without mechanical failure.

## CONSTANT-DIRECTIVITY SPEAKER SYSTEM DIRECTIVITY

A unique feature of the T221 is the constant-directivity dispersion provided by the 60° x 40° horn. The polar response of the system at selected one-third-octave bandwidths is shown in Figure 1. These polar responses were mea-

sured in an anechoic environment at 20 feet using one-third-octave pink-noise input. The frequencies selected are fully representative of the polar response of the system. Beamwidth of the system utilizing the complete one-third-octave polar data is shown in Figure 3.  $R_0$  and directivity index (DI) are plotted in Figure 4.

The crossover frequency and speaker component geometries have been selected so that the directional characteristics of the woofer and constant-directivity horn match at the crossover frequency to create a special system type—the constant-directivity system. At higher frequencies the horizontal coverage pattern smoothly tapers to 60°, then remains constant and the vertical pattern smoothly transitions to a 40° angle above 3,000 Hz. Response within the 60° x 40° rated coverage angle is uniform, which means dependable audience coverage without "hot spots" or dead zones at certain frequencies. The 60° x 40° dispersion characteristic also helps avoid early reflections from nearby floor or side wall surfaces which could degrade performance. The controlled directivity of the high- and low-frequency transducers also eliminates response irregularities caused by diffraction off nearby enclosure edges and, in combination with an essentially flat on-axis frequency response, produces a total acoustic power output that is uniform with frequency.

## ENCLOSURE CONSTRUCTION

A combination of dado-cut joints, tough adhesives and proper bracing ensures a sonically dead enclosure free from panel resonances.

The densely woven, industrial-grade, abuse-resistant carpeting provides a finish that is both attractive and highly durable. Large, heavy-duty metal corner protectors, firmly secured rubber feet and recessed handles complete the picture and ensure that the T221 speaker system is ideally suited for a long and reliable life "on the road."

## ROTATING THE HIGH-FREQUENCY HORN

The T221 high-frequency horn may be easily rotated about its major axis, providing coverage independent of enclosure orientation. First remove the enclosure grille, then the horn. Both are affixed with #2 Phillips-head screws. Rotate the horn 90° about its axis and reinstall the components.

## CONNECTIONS

Blamped or passive crossover operation is achieved with Neutrik Speakon® connectors. In full range mode, only pins 1+ and 1- are used to supply power to the system.

## BIAMPED OPERATION

The T221 is shipped from the factory in "full-range mode" with its passive crossover utilized. If biamp operation is desired, this is easily achieved. The input panel/crossover assembly (on the back of the system) must first be removed using a #2 Phillips screwdriver. After removing the input panel/crossover assembly, notice the crossover instruction label on the side of the input panel. There are four automotive fuses on the printed circuit board. These fuses are not functioning as fuses, but rather are functioning together as a four pole switch.

To convert the T221 to biamp operation, move each fuse over one position. The fuses should, once again, all be in one straight column and nearest the word BIAMP on the printed circuit board. Replace the input panel/crossover assembly in the enclosure and carefully replace the screws—being careful not to strip the holes. To return the system to full-range operation, repeat the steps in a similar manner. Remember, all fuses must be arranged in one vertical column for safe, proper operation.

A fourth-order active crossover with a crossover frequency of 1,200 Hz (1.2 kHz), is recommended.

Neutrik Speakon® connectors are used. Pins 1+/1- are wired to the low-frequency driver and pins 2+/2- to the high-frequency section. The high-frequency section incorporates a low-frequency blocking capacitor with a 3-dB-down point of 800 Hz and PRO™ circuit auto resetting overload protection.

## FREQUENCY RESPONSE

The combination of a 12-inch woofer, wide-bandwidth high-frequency driver and an equalized crossover results in the wide and smooth overall response shown in Figure 2. The T221's axial frequency response was measured in Electro-Voice's large anechoic chamber at a distance of 10 feet with a swept sine-wave input of 4 volts. Figure 2 has been smoothed and corrected for 1 watt/1 meter.

## POWER-HANDLING CAPACITY

Electro-Voice components and systems are manufactured to exacting standards, ensuring they will hold up, not only through the most rigorous of power tests, but also through continued use in arduous, real-life conditions. The EIA Loudspeaker Power Rating Full Range (ANSI/EIA RS-426-A 1980) uses a noise spectrum which mimics typical music and tests the thermal and mechanical capabilities of the components. The duration of this test is eight hours. Electro-Voice will support relevant additional standards as and when they become available. Extreme, in-house power tests, which push the performance boundaries of the components, are also performed and passed to ensure years of trouble-free service.

Specifically, the T221 passes ANSI/EIA RS-426-A 1980 with the following values:

$$R_{SR} = 5.98 \text{ ohms } (1.15 \times R_E)$$

$$P_{E(MAX)} = 400 \text{ watts}$$

$$\text{Test voltage} = 48.9 \text{ volts rms,} \\ 97.8 \text{ volts peak}$$

The "peak" power-handling capacity of a system is determined by the peak test voltage amount. For the T221, an 97.8-volt peak test voltage translates into 1,600-watts short-term peak power-handling capacity. This is the equivalent of four times the "average" power-handling capacity, and is a peak that can be sustained for only a few milliseconds. However, this sort of short duration peak is very typical in speech and music. Provided the amplifier can reproduce the signal accurately, without clipping, the system will also perform accurately and reliably, even at these levels.

## ARCHITECTS' AND ENGINEERS' SPECIFICATIONS

The loudspeaker system shall be a two-way, full-range design consisting of a 305-mm (12-inch) woofer in a vented, trapezoidal-shaped enclosure, a high-frequency compression driver mounted on a 60° x 40° constant-directivity horn, and a passive crossover/equalizer network. The loudspeaker shall meet the following performance criteria: frequency response of 78-16,000 Hz, -3 dB; power handling of 400 watts long term and 1,600 watts short term with a shaped random-noise input per ANSI/EIA RS-426-A 1980; sensitivity of 100 dB SPL at 1 meter with a 1-watt, 300- to 2,000-Hz pink-noise input; 6-dB-down horizontal coverage angle of 60° (+13°, -9°) in the 3,150-20,000-Hz range; 6-dB-down vertical coverage angle of 40° (+20°, -2°) in the 3,150-20,000-Hz range; crossover frequency of 2,200 Hz; nominal impedance of 8 ohms; and minimum impedance of 7.0 ohms. Input connections shall be two paralleled Neutrik Speakon® NL4-type connectors. The enclosure shall be constructed of 7-ply void-free plywood, covered in black carpet and fitted with a black steel grille, metal corner protectors, rubber feet and two recessed carrying handles. Dimensions shall be 714 mm (28.1 in.) high x 417 mm (16.4 in.) wide at front x 170 mm (6.7 in.) wide at rear x 480 mm (18.9 in.) deep. Net weight shall be 25 kg (55 lb).

The loudspeaker system shall be the Electro-Voice T221.

## WARRANTY (LIMITED)

Electro-Voice products are guaranteed against malfunction due to defects in materials or workmanship for a specified period, as noted in the individual product-line statement(s) below, or in the individual product data sheet or owner's manual, beginning with the date of original purchase. If such malfunction occurs during the specified period, the product will be repaired or replaced (at our option) without charge. The product will be returned to the customer prepaid. Exclusions and Limitations: The Limited Warranty does not apply to: (a) exterior finish or appearance; (b) certain specific items described in the individual product-line statement(s) below, or in the individual product data sheet or owner's manual; (c) malfunction resulting from use or operation of the product other than as specified in the product data sheet or owner's manual; (d) malfunction resulting from misuse or abuse of the product; or (e) malfunction occurring at any time after repairs have been made to the product by anyone other than Electro-Voice or any of its authorized service representatives. Obtaining Warranty Service: To obtain warranty service, a customer must deliver the product, prepaid, to Electro-Voice or any of its authorized service representatives together with proof of purchase of the product in the form of a bill of sale or receipted invoice. A list of authorized service representatives is available from Electro-Voice at 600 Cecil Street, Buchanan, MI 49107 (616/695-6831 or 800/234-6831). Incidental and Consequential Dam-

ages Excluded: Product repair or replacement and return to the customer are the only remedies provided to the customer. Electro-Voice shall not be liable for any incidental or consequential damages including, without limitation, injury to persons or property or loss of use. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. Other Rights: This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Electro-Voice Speakers and Speaker Systems are guaranteed against malfunction due to defects in materials or workmanship for a period of five (5) years from the date of original purchase. The Limited Warranty does not apply to burned voice coils or malfunctions such as cone and/or coil damage resulting from improperly designed enclosures. Electro-Voice active electronics associated with the speaker systems are guaranteed for three (3) years from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

Service and repair address for this product: Electro-Voice, Inc., 600 Cecil Street, Buchanan, Michigan 49107 (616/695-6831 or 800/234-6831).

Specifications subject to change without notice.



# ELECTRO-VOICE

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